

PATENT ABSTRACTS OF JAPAN

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(71)Applicant : TEIJIN CHEM LTD

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(72)Inventor : HIRONAKA YOICHI
MORIMOTO NAOYOSHI
FUJII KOJI

(54) PRODUCTION OF BROMINATED POLYSTYRENE

(57)Abstract:

PURPOSE: To obtain a brominated polystyrene which has a satisfactory hue and excellent heat resistance and is widely usable as a flame retardant.

CONSTITUTION: This production method comprises reacting a polystyrene with bromine in a halogenated hydrocarbon solvent using a catalyst comprising a combination of an aluminum halide and an aluminum powder.

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CLAIMS

[Claim(s)]

[Claim 1] The manufacture approach of the bromination polystyrene characterized by using aluminum halide and an aluminium powder as a catalyst in the approach of making polystyrene and a bromine reacting in a halogenated hydrocarbon solvent, and manufacturing bromination polystyrene.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Industrial Application] This invention relates to the bromination approach of polystyrene. Furthermore, it is related with the approach of making polystyrene and a bromine reacting in a halogenated hydrocarbon solvent, and manufacturing bromination polystyrene in detail. The bromination polystyrene obtained by this invention is broadly used as a flame retarder for plastics.

[0002]

[Description of the Prior Art] Conventionally, as a manufacturing method of bromination polystyrene, the approach of carrying out the polymerization of the bromination styrene monomer is learned. The bromination polystyrene obtained by this approach can be said to be the approach excellent in the point that the bromination polystyrene of high bromine content can be manufactured by having the outstanding color tone and the outstanding thermal property, and using 3 bromination styrene for a monomer. However, this approach lacks in economical efficiency -- the process which removes the monomer which remains after that the bromination styrene monomer which is a raw material is expensive, and polymerization reaction termination is needed -- and practicality.

[0003] Furthermore, how to brominate polystyrene is also learned as the industrial manufacture approach of bromination polystyrene. This approach has the trouble which the bromination polystyrene of the color tone and the thermal property of it being not only economical, but having high bromine content and having excelled although it was the approach excellent in the point that bromine content can be adjusted to arbitration cannot acquire easily.

[0004] According to this approach, although two bromines per ring piece are permuted easily, if it is going to obtain the bromination polystyrene of further more high bromine content, not only bromination of the nucleus of polystyrene but bromination of a hydrocarbon principal chain and cutting will take place as side reaction, and the thermal resistance of the obtained bromination polystyrene will usually fall. When such bromination polystyrene is blended with thermoplastics, since the physical properties and appearance of the obtained mold goods falling and the bromination polystyrene obtained by doing in this way generate a hydrogen bromide on the occasion of a pyrolysis, it has the fault that the use field is extremely restricted on the occasion of practical use, such as corroding metal mold, at the time of fabrication.

[0005] Although there are an approach using the catalyst of low activity like 3 halogenation iron as an approach of solving these problems, a method of reducing the amount of catalysts, the approach of lowering reaction temperature, etc., by such approach, the problem of being unable to attain the desired bromine content to which reaction time becomes long occurs.

[0006] Furthermore, the bromination technique for solving these problems is indicated by many patent specifications. For example, in JP,1-57684,B, the method of using a bromine chloride for a brominating agent and using halogenation antimony for a catalyst is proposed. However, by this approach, there is a fault that a part of the production process of a bromine chloride being needed and bromination polystyrene obtained are chlorinated. Moreover, in JP,61-34723,B, under existence of the nucleophilicity agent like water, although the approach of brominating adjusting catalytic activity is proposed, adjustment of a minute amount moisture content is needed, and a problem is in practicality. Moreover, although the method of using the double salt of an alkali-metal halogenide and halogenation iron as a catalyst is proposed in JP,62-58604,B, the bromination polystyrene of high bromine content cannot be obtained by this approach.

[0007]

[Problem(s) to be Solved by the Invention] This invention is faced brominating polystyrene and manufacturing bromination polystyrene, and does not have the above-mentioned fault, it is good and a hue aims at offering the

approach of manufacturing economically high bromine content polystyrene excellent in thermal resistance efficiently. [0008] Without extending reaction time by using aluminum halide and an aluminium powder for a catalyst, as a result of inquiring further paying attention to the ability to reduce the substantial amount of catalysts by using together aluminum halide and an aluminium powder for a catalyst as a result of attaining the above-mentioned purpose and inquiring wholeheartedly, this invention persons of a hue are good, and reach the approach of bromination polystyrene **** this invention that thermal resistance has also been improved remarkably.

[0009]

[Means for Solving the Problem] This invention relates to the bromination approach of the polystyrene characterized by using together aluminum halide and an aluminium powder as a catalyst in the approach of making polystyrene and a bromine reacting in a halogenated hydrocarbon solvent, and manufacturing bromination polystyrene.

[0010] Although there will be especially no limitation if it does not react with a bromine and deactivation of the catalyst is not carried out as a solvent used by this invention, saturation aliphatic series halogenated hydrocarbon, such as a methylene chloride, a dichloroethane, trichloroethane, dichloro dibromoethane, dibromoethane, tetrabromo ethane, and a carbon tetrachloride, is mentioned, for example. These may be the solvents which carried out dehydration processing not only of an anhydrous solvent but the recovery solvent, and were substantially changed into the anhydrous condition. Also in these, a methylene chloride is desirable practically.

[0011] As polystyrene used by this invention, about 10,000 to 500,000 thing is used with weight average molecular weight, and the thing of 20,000-250,000 is desirable especially.

[0012] Although it is desirable to use 1-3 mols to one mol of benzene rings of polystyrene as for the bromine used as a brominating agent by this invention, in order to manufacture the high bromination polystyrene of especially bromine content, it is desirable to use a 2-3-mol bromine.

[0013] The description of this invention is to use together aluminum halide and an aluminium powder as a catalyst. As aluminum halide, although an aluminum chloride, the aluminium bromide, and an aluminium iodide are mentioned, especially an aluminum chloride is desirable. Although there is especially no limitation as a gestalt of aluminum halide and the aluminium powder used together, in consideration of distribution in side reaction and reaction mixture etc., the thing of the shape of a high grade and impalpable powder is desirable. Moreover, you may add with aluminum halide before bromine dropping, and in the middle of bromine dropping, although any are sufficient as the addition stage of an aluminium powder after bromine dropping termination, it is desirable [a stage] to add to aluminum halide and coincidence before bromine dropping practically. since reaction time will become long if it is not much alike and there is little amount of the catalyst used -- practically -- the sum of the stoichiometry of aluminum halide and an aluminium powder -- per one mol of rings of polystyrene -- usually -- 0. 1-10-mol % -- it is 1-5-mol % preferably. Moreover, although the rates of aluminum halide and an aluminium powder are 1/0.01-0.01/1 in a weight ratio, since there is an inclination for coloring of the bromination polystyrene which will be obtained if the rate of aluminum is made high to become large, they are 1 / 0.1 - 1/1 preferably.

[0014] A bromine is dropped, after usually dissolving polystyrene in the above-mentioned organic solvent and throwing in the aluminum halide and the aluminium powder of the specified quantity subsequently, if it is in this invention. A bromination reaction is performed by dropping a bromine, holding preferably 0-30 degrees C of temperature at 5-20 degrees C. There is an inclination for coloring of the bromination polystyrene from which it will be obtained if a rate of reaction becomes slow at less than 0 degree C and reaction temperature is higher than 30 degrees C to become large. It holds at further 5-15 degrees C after dropping termination, stirring is continued for 10 minutes - 2 hours, and a reaction is completed. After reaction termination, a reaction solution is thrown in underwater, or water is fed into a reaction solution, deactivation of the catalyst is carried out, a water layer is separated, an organic solvent layer is washed with water, and an impurity is removed. For isolating the bromination polystyrene contained in the organic solvent layer after washing, an organic solvent layer may be poured out into lower alcohol, such as the approach of arbitration, for example, a methanol etc., and the saturated aliphatic hydrocarbon of carbon numbers 5-8, and you may make it deposit, and a reaction solvent layer is poured out into warm water, and a solvent may be evaporated and may be deposited. Moreover, it is good also by the approach of distilling off a solvent under the vacuum like spray drying.

[0015] The bromination polystyrene obtained by the approach of this invention has 1-3 bromine atoms per ring of polystyrene, and since it excels in a hue or thermal resistance, they can be broadly used for it as flame retarders for plastics, such as a polycarbonate, polyester, polypropylene, styrene resin, and a polyamide.

[0016]

[Example] An example is raised to below and this invention is further explained to it. In addition, the following approach estimated the hue in an example, and thermal resistance.

[0017] Color Phase: The obtained bromination polystyrene was dissolved in the 50ml methylene chloride after 0.10g weighing capacity, and the hue (APHA) was measured for this solution as compared with the HAZEN standard color solution. It is shown that a hue is so good that a value is small.

[0018] Thermal resistance: With the 1090by TA instrument company B mold thermal-analysis system 951 mold TGA, the programming rate in nitrogen-gas-atmosphere mind of 20 degrees C / min estimated at loss-in-quantity temperature 3%.

[0019]

[Example 1] 530g of methylene chlorides and polystyrene [Dainippon Ink ERASUCHIREN 200 and weight-average-molecular-weight 55,000] 34g were taught to the 4 opening flask with a capacity of 1l. which attached the thermometer, the dropping funnel, and the cooling pipe, and after holding at 5-7 degrees C and throwing in 1.15g of bottom aluminum chlorides of stirring, and 0.07g of aluminium powders, it was dropped at 5-10 degrees C, having covered [139g] it for 45 minutes. It stirred after dropping termination for further 1 hour, and the reaction was completed. The obtained reaction solution was dropped at underwater [250ml] over 10 minutes, and deactivation of the catalyst was carried out. The water layer was removed, the organic solvent layer was further dropped [with 400ml water / after 2 times washing and filtration] over 1 hour under stirring into 400ml warm water (50-80 degrees C), the depositing solid-state was dried the ** exception, and bromination polystyrene (67% [of bromine content], 2.65Br objects) 94g of white was obtained. The hue of the obtained bromination polystyrene and the heat-resistant evaluation result were shown in Table 1.

[0020]

[Examples 2-4] It inquired by the same approach as an example 1 except having changed the amount of an aluminum chloride and the aluminium powder used. The hue of the bromination polystyrene obtained on that occasion and the heat-resistant evaluation result were combined, and were shown in Table 1.

[0021]

[The example 1 of a comparison] 530g of methylene chlorides and polystyrene [Dainippon Ink ERASUCHIREN 200 and weight-average-molecular-weight 55,000] 34g were taught to the 4 opening flask with a capacity of 1l. which attached the thermometer, the dropping funnel, and the cooling pipe, and after holding at 5-7 degrees C and supplying 1.70g of bottom aluminum chlorides of stirring, it was dropped at 5-10 degrees C, having covered [139g] it for 45 minutes. It stirred after dropping termination for further 1 hour, and the reaction was completed. The obtained reaction solution was dropped at underwater [250ml] over 10 minutes, and deactivation of the catalyst was carried out. The water layer was removed, the organic solvent layer was further dropped [with 400ml water / after 2 times washing and filtration] over 1 hour under stirring into 400ml warm water (50-80 degrees C), the depositing solid-state was dried the ** exception, and bromination polystyrene (67% [of bromine content], 2.65Br-objects) 92g of white was obtained. The hue of the obtained bromination polystyrene and the heat-resistant evaluation result were written together with the example to Table 1.

[0022]

[The example 2 of a comparison] 530g of methylene chlorides and polystyrene [Dainippon Ink ERASUCHIREN 200 and weight-average-molecular-weight 55,000] 34g were taught to the 4 opening flask with a capacity of 1l. which attached the thermometer, the dropping funnel, and the cooling pipe, and after holding at 7 degrees C and supplying 1.49g of bottom aluminum chlorides of stirring, it was dropped at 5-10 degrees C, having covered [139g] it for 45 minutes. It stirred after dropping termination for further 1 hour, and the reaction was completed. The obtained reaction solution was dropped at underwater [250ml] over 10 minutes, and deactivation of the catalyst was carried out. At this time, the water layer was ****(ed) brown and survival of an unreacted bromine was checked. The water layer was removed, the organic solvent layer was further dropped [with 400ml water / after 2 times washing and filtration] over 1 hour under stirring into 400ml warm water (50-80 degrees C), the depositing solid-state was dried the ** exception, and bromination polystyrene (65% [of bromine content], 2.35Br objects) 88g of white was obtained. The hue of the obtained bromination polystyrene and the heat-resistant evaluation result were written together to Table 1.

[0023]

[Table 1]

	触媒量		色相	耐熱性	Br Cont.	収量
	AlCl ₃ [g]	Al [g]	(APHA) [-]	TGA-3%減量 [°C]	カリウス法 [%]	[g]
実施例 1	1.15	0.07	25	385	67	94
2	1.00	0.10	10	383	67	95
3	0.87	0.13	35	384	67	94
4	0.76	0.15	35	386	67	92
比較例 1	1.70	-	15	372	67	92
2	1.49	-	35	125	65	88

[0024]

[Effect of the Invention] A hue and thermal resistance are excellent in the bromination polystyrene obtained by the approach of this invention, and it can be broadly used as a flame retarder. Especially, the approach of this invention faces brominating polystyrene and demonstrates remarkable effectiveness to a heat-resistant improvement of the bromination polystyrene obtained.

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(21) 出願番号	特願平5-273483	(71) 出願人	000215888 帝人化成株式会社 東京都港区西新橋1丁目6番21号
(22) 出願日	平成5年(1993)11月1日	(72) 発明者	広中 洋一 東京都港区西新橋1丁目6番21号 帝人化成株式会社内
		(72) 発明者	森本 直芳 東京都港区西新橋1丁目6番21号 帝人化成株式会社内
		(72) 発明者	藤井 幸司 東京都港区西新橋1丁目6番21号 帝人化成株式会社内
		(74) 代理人	弁理士 前田 純博

(54) 【発明の名称】 臭素化ポリステレンの製造方法

(57) 【要約】

【目的】 色相が良好で且つ耐熱性に優れており難燃剤として幅広く用いることができる臭素化ポリステレンの製造法を提供する。

【構成】 ハロゲン化炭化水素溶液中でポリステレンと臭素とを反応させて臭素化ポリステレンを製造する方法において、触媒としてハロゲン化アルミニウムおよびアルミニウム粉末を用いることを特徴とする臭素化ポリステレンの製造方法。

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【特許請求の範囲】

【請求項1】 ハロゲン化炭化水素溶媒中でポリスチレンと臭素とを反応させて臭素化ポリスチレンを製造する方法において、触媒としてハロゲン化アルミニウムおよびアルミニウム粉末を用いることを特徴とする臭素化ポリスチレンの製造方法。

【発明の詳細な説明】

【0001】

【産業上の利用分野】本発明はポリスチレンの臭素化方法に関する。更に詳しくは、ハロゲン化炭化水素溶媒中でポリスチレンと臭素とを反応させて臭素化ポリスチレンを製造する方法に関する。本発明によって得られる臭素化ポリスチレンは、プラスチック用の難燃剤として幅広く使用されるものである。

【0002】

【従来の技術】従来、臭素化ポリスチレンの製造法としては、臭素化スチレン単量体を重合する方法が知られている。該方法によって得られる臭素化ポリスチレンは優れた色調および熱的特性を有しており、且つ単量体に三臭素化スチレンを用いることで高い臭素含有率の臭素化ポリスチレンを製造できる点では優れた方法と言える。しかしながら、該方法は原料である臭素化スチレン単量体が高価であること、重合反応終了後、残存するモノマーを除去する工程が必要になることなど経済性、実用性に欠ける。

【0003】更に、臭素化ポリスチレンの工業的製造方法として、ポリスチレンを臭素化する方法も知られている。該方法は、経済的であるだけでなく、臭素含有率を任意に調整できる点で優れた方法であるが、高い臭素含有率を有しかつ優れた色調および熱的特性の臭素化ポリスチレンが得にくい問題点がある。

【0004】該方法によれば、通常、芳香環一個あたり二個の臭素までは容易に置換されるが、更に高い臭素含有率の臭素化ポリスチレンを得ようとすると、ポリスチレンの芳香核の臭素化のみならず、炭化水素主鎖の臭素化、切断が副反応として起こり、得られた臭素化ポリスチレンの耐熱性が低下する。このような臭素化ポリスチレンを熱可塑性樹脂に配合した際、得られた成形品の物性や外観が低下すること、またこのようにして得られた臭素化ポリスチレンは熱分解に際して臭化水素を発生するため成形加工時に金型を腐食する等、実用性に際してその使用領域が極めて制限されるという欠点がある。

【0005】これらの問題を解決する方法としては、三ハロゲン化鉄の如きより低活性の触媒を用いる方法、触媒量を低減する方法、反応温度を下げる方法等があるが、このような方法では反応時間が長くなる、所望の臭素含有率が達成できない等の問題が発生する。

【0006】さらに、これらの問題を解決するための臭

素、触媒にハロゲン化アンチモンを用いる方法が提案されている。しかし、該方法では塩化臭素の製造工程が必要となること、得られる臭素化ポリスチレンが一部塩素化されるという欠点がある。また、特公昭61-34723号公報では、水の如き求核試剤の存在下、触媒活性を調整しつつ臭素化する方法が提案されているが、微量水分量の調整が必要となり実用性に問題がある。また、特公昭62-58604号公報では、触媒としてアルカリ金属ハロゲン化物とハロゲン化鉄との複塩を用いる方法が提案されているが、該方法では高い臭素含有率の臭素化ポリスチレンは得ることができない。

【0007】

【発明が解決しようとする課題】本発明は、ポリスチレンを臭素化して臭素化ポリスチレンを製造するに際し、上記欠点が無く、色相が良好で且つ耐熱性に優れた高臭素含有ポリスチレンを経済的に効率よく製造する方法を提供することを目的とする。

【0008】本発明者らは、上記目的を達成せんとして鋭意検討した結果、触媒にハロゲン化アルミニウムおよびアルミニウム粉末を併用することにより実質的な触媒量を低減できることに着目し、更に検討した結果、触媒にハロゲン化アルミニウムとアルミニウム粉末を用いることにより、反応時間を延長する事なく、色相も良好で且つ耐熱性も著しく改善された臭素化ポリスチレンを得る本発明の方法に到達したものである。

【0009】

【課題を解決するための手段】本発明は、ハロゲン化炭化水素溶媒中でポリスチレンと臭素とを反応させて臭素化ポリスチレンを製造する方法において、触媒としてハロゲン化アルミニウム及びアルミニウム粉末を併用することを特徴とするポリスチレンの臭素化方法に係わるものである。

【0010】本発明で使用する溶媒としては、臭素と反応せず、触媒を失活させないものであれば特に限定はないが、例えば塩化メチレン、ジクロロエタン、トリクロロエタン、ジクロロジプロモエタン、ジプロモエタン、テトラプロモエタン、四塩化炭素等の飽和脂肪族ハロゲン化炭化水素が挙げられる。これらは無水の溶媒だけでなく、回収溶剤を脱水処理して実質的に無水状態にした溶媒であってもよい。これらのなかでも、塩化メチレンが実用上好ましい。

【0011】本発明で使用するポリスチレンとしては、重畳平均分子量で10,000～500,000程度のものが使用され、中でも20,000～250,000のものが好ましい。

【0012】本発明で臭素化剤として使用する臭素は、ポリスチレンのベンゼン環1モルに対し1～3モル使用するのが好ましいが、特に臭素含有率の高い臭素化ポリ

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【0013】本発明の特徴は、触媒としてハロゲン化アルミニウムおよびアルミニウム粉末を併用することにある。ハロゲン化アルミニウムとしては、塩化アルミニウム、臭化アルミニウム、ヨウ化アルミニウムが挙げられるが、特に塩化アルミニウムが好ましい。ハロゲン化アルミニウム及び併用するアルミニウム粉末の形態としては特に限定は無いが、副反応、反応液中での分散等を考慮して、高純度且つ微粉末状のものが好ましい。また、アルミニウム粉末の添加時期は、臭素滴下前にハロゲン化アルミニウムと共に添加してもよいし、臭素滴下途中、臭素滴下終了後何れでもよいが、実用上臭素滴下前にハロゲン化アルミニウムと同時に添加する事が好ましい。触媒の使用量は余りに少ないと反応時間が長くなるため、実用上ハロゲン化アルミニウムとアルミニウム粉末の化学量論的の和がポリスチレンの芳香環1モル当り、通常0.1~10モル%、好ましくは1~5モル%である。また、ハロゲン化アルミニウムとアルミニウム粉末との割合は、重量比で1/0.01~0.01/1であるが、アルミニウムの割合を高くすると得られる臭素化ポリスチレンの着色が大きくなる傾向があるので、好ましくは1/0.1~1/1である。

【0014】本発明にあつては、通常上記有機溶媒にポリスチレンを溶解し、次いで所定量のハロゲン化アルミニウムおよびアルミニウム粉末を投入した後、臭素を滴下する。臭素化反応は温度を0~30℃、好ましくは5~20℃に保持しながら臭素を滴下することによって行う。反応温度が0℃未満では反応速度が遅くなり、30℃より高いと得られる臭素化ポリスチレンの着色が大きくなる傾向がある。滴下終了後更に5~15℃に保持して10分~2時間攪拌を継続して反応を完結させる。反応終了後、反応溶液を水中に投入するか反応溶液に水を投入して触媒を失活させ、水層を分離し、有機溶媒層を水で洗浄して不純物を除去する。洗浄後の有機溶媒層に含まれる臭素化ポリスチレンを単離するには任意の方法。例えばメタノール等の低級アルコール類、炭素数5~8の飽和脂肪族炭化水素中に有機溶媒層を注いで析出させてもよいし、温水中に反応溶媒層を注ぎ、溶媒を蒸発させて析出させてもよい。また、スプレー乾燥の如き真空中で溶媒を留去する方法によってもよい。

【0015】本発明の方法で得られる臭素化ポリスチレンは、ポリスチレンの芳香環1個当り1~3個の臭素原子を有し、色相や耐熱性に優れているので例えばポリカーボネート、ポリエステル、ポリプロピレン、スチレン系樹脂、ポリアミド等のプラスチック用難燃剤として幅広く使用できる。

【0016】

【実施例】以下に実施例をあけて本発明を更に説明する。なお、実施例中の色相および耐熱性は下記の方法に

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0.10g秤量後、50mlの塩化メチレンに溶解し、この溶液をハーゼン色数標準液と比較して色相(ApH A)を測定した。値は小さい程色相が良いことを示す。

【0018】耐熱性：TAインスツルメント社製1090B型熱分析システム951型TGAにより、窒素雰囲気中昇温速度20℃/minで3%減量温度にて評価した。

【0019】

【実施例1】温度計、滴下ロートおよび冷却管を付した容量1lの四つ口フラスコに塩化メチレン530g及びポリスチレン〔大日本インキ(株)製エラストレン200、重畳平均分子量55,000〕34gを仕込み、5~7℃に保持して攪拌下塩化アルミニウム1.15gおよびアルミニウム粉末0.07gを投入した後、5~10℃にて臭素139gを45分間かけて滴下した。滴下終了後更に1時間攪拌して反応を完結した。得られた反応溶液を250mlの水中へ10分かけて滴下して触媒を失活させた。水層を除去し、更に有機溶媒層を400mlの水で2回洗浄、濾過後400mlの温水中(50~80℃)へ攪拌下1時間かけて滴下し、析出した固体を濾別、乾燥して白色の臭素化ポリスチレン(臭素含有率67%、2.65Br体)94gを得た。得られた臭素化ポリスチレンの色相、耐熱性の評価結果を表1に示した。

【0020】

【実施例2~4】塩化アルミニウムおよびアルミニウム粉末の使用量を変更した以外は実施例1と同様な方法により検討を行った。その際に得られた臭素化ポリスチレンの色相、耐熱性の評価結果を併せて表1に示した。

【0021】

【比較例1】温度計、滴下ロートおよび冷却管を付した容量1lの四つ口フラスコに塩化メチレン530g及びポリスチレン〔大日本インキ(株)製エラストレン200、重畳平均分子量55,000〕34gを仕込み、5~7℃に保持して攪拌下塩化アルミニウム1.70gを投入した後、5~10℃にて臭素139gを45分間かけて滴下した。滴下終了後更に1時間攪拌して反応を完結した。得られた反応溶液を250mlの水中へ10分かけて滴下して触媒を失活させた。水層を除去し、更に有機溶媒層を400mlの水で2回洗浄、濾過後400mlの温水中(50~80℃)へ攪拌下1時間かけて滴下し、析出した固体を濾別、乾燥して白色の臭素化ポリスチレン(臭素含有率67%、2.65Br体)92gを得た。得られた臭素化ポリスチレンの色相、耐熱性の評価結果を表1に実施例と共に併記した。

【0022】

【比較例2】温度計、滴下ロートおよび冷却管を付した容量1lの四つ口フラスコに塩化メチレン530g、及

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7℃に保持して攪拌下塩化アルミニウム1.49gを投入した後、5～10℃にて臭素139gを45分間かけて滴下した。滴下終了後更に1時間攪拌して反応を完結した。得られた反応溶液を250mlの水中へ10分かけて滴下して触媒を失活させた。この時、水層は褐色に帯色しており、未反応臭素の残存が確認された。水層を除去し更に有機溶媒層を400mlの水で2回洗浄、濾*

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*過後400mlの温水中(50～80℃)へ攪拌下1時間かけて滴下し、析出した固体を濾別、乾燥して白色の臭素化ポリスチレン(臭素含有率65%、2.35Br/体)88gを得た。得られた臭素化ポリスチレンの色相、耐熱性の評価結果を表1に併記した。

【0023】

【表1】

	触媒量		色相	耐熱性	Br Cont.	収量
	AlCl ₃ [g]	Al [g]	(APHA) [-]	TGA-3%減量 [℃]	カリウム法 [%]	[g]
実施例1	1.15	0.07	25	385	67	94
2	1.00	0.10	10	383	67	95
3	0.87	0.13	35	384	67	94
4	0.76	0.15	35	386	67	92
比較例1	1.70	-	15	372	67	92
2	1.49	-	35	125	65	88

【0024】

【発明の効果】本発明の方法によって得られる臭素化ポリスチレンは色相、耐熱性共に優れており難燃剤として

幅広く使用することができる。特に、本発明の方法はポリスチレンを臭素化するに際し、得られる臭素化ポリスチレンの耐熱性改善に著しい効果を発揮する。

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